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To: Commissioner of Patents and Trademarks
Washington, D.C. 20231

ATTN: GROUP ART UNIT 2814 D. FARAHANI

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Subject:

Serial No. 09/804,389	03/13/01
"Twin current bipolar device with hi-lo base profile"	
J-L Tsai, R-H Liu, C-S Peng, & K-C Liu	
Grp. Art Unit : 2814	D. Farahani

APPEAL BRIEF

Dear Sir:

In response to the rejection of the claims in the above identified application for patent, made in the Final Rejection on 05/20/02 and in the Advisory Action dated 08/26/02, Applicant filed a NOTICE OF APPEAL on 09/26/02. Please accept our APPEAL BRIEF herewith together with the FEE of $320. No oral hearing is requested.

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231 on November 12, 2002.

Name Stephen B. Ackerman, Reg #37,761

Signature/Date 11/12/02

APPEAL BRIEF

1. Real Party in Interest:

An assignment has been recorded for this patent application.

The assignee is

Taiwan Semiconductor Manufacturing Corporation

121 Park Avenue III

Science Based Industrial Park

Hsinchu, TAIWAN, R.O.C.

2. Related Appeals and Interferences:

There are no related appeals or interferences.

3. Status of Claims:

The original application contained 20 claims and was filed on 02/05/99. Following a restriction of claims, claims 1-11 were filed separately and issued as US 6,211,028 B1 on April 3 2001. A divisional application was filed on 03/13/01, covering claims 12-20. Since then, no claims have been added, canceled, or amended. No claims have been allowed.

4. Status of Amendments

There have been no amendments to any claim at any time.

5. Summary of the Invention:

The invention discloses a bipolar transistor whose I-V curve is such that it operates in two regions, one having low gain and low power consumption and another having higher gain and better current driving ability. This transistor has a base region made up of two sub regions, the region closest to the emitter having a resistivity about an order a magnitude lower than the second region (which interfaces with the collector). The key novel feature of the invention is that the region closest to the collector is very uniformly doped, i.e. there is no ion concentration gradient (and therefor no built-in field).

CLAIM 12 READS ON THE SPECIFICATION AND FIGURES AS FOLLOWS:

12. A twin gain bipolar transistor comprising:

an N type silicon body having an upper surface;

an N+ buried collector located a first distance below said upper surface and having a thickness; [ELEMENT 32 IN FIG. 6]

a secondary base region comprising P type silicon, [ELEMENT 40 IN FIG. 6] throughout which boron ions are uniformly distributed, [SPECIFICATION: 1st TWO PARAGRAPHS ON PAGE 7] and extending a second distance below said upper surface;

a primary base region of boron doped P+ silicon [ELEMENT 53 IN FIG. 6], wholly within said secondary base region and extending a third distance below said upper surface; and

an emitter region [ELEMENT 64 IN FIG. 6] comprising a region of N+ silicon wholly within the primary base region and extending a fourth distance below said upper surface.

6. Issues:

The issues are whether all claims should be rejected under 35 USC 103(a) as being unpatentable over Morishita (US 5,140,400) in view of Frisina et al. (US 5,939,769).

7. Grouping of Claims:

All claims stand or fall together.

8. Argument:

Morishita is cited to show that buried collectors are known while Frisina et al. is relied on to teach that the base region of a bipolar device may contain a sub-base region surrounding a primary base layer. However, neither prior art invention teaches that such a sub-base must be very uniformly doped with acceptor ions, i.e. that the concentration gradient of acceptor ions across the thickness of the sub-base must be zero. This condition cannot be met (nor is it taught) by Frisina et al. In fact, the presence of a concentration gradient in the base layer of transistors has been standard practice for about 40 years and is generally regarded as desirable since it reduces the time for electrons to transit the base.

It is no accident that Frisina et al. chose aluminum as their acceptor ion, rather than boron. Aluminum diffuses at about ten times the rate of boron so it is always to be preferred when a layer is to be formed through diffusion (as is the case for Frisina et al.). On the other hand, in order to obtain a uniform dopant distribution, the present invention uses doped epitaxial deposition with boron as the dopant of choice (since it is essential to keep diffusion

of acceptor ions to a minimum in this case).

In his first rejection, Examiner made no reference to the key feature of the present invention, namely the absence of any dopant concentration gradient in the sub-base. When this was pointed out to him, in our response to the first rejection, he stated in the final rejection that he was not persuaded because "...uniform gradient distribution is also a gradient distribution of a gradient factor of one.". Since we had (and continue to have) no idea what this means, clarification was requested.

Examiner provided the following clarification in his advisory:
".... the absence of a concentration gradient in the base region, which is allegedly a novel feature of the invention, is same as a gradient of 1, or zero. This means that the absence of a gradient, which is same as if there is no gradient, is same as there is a gradient, but the concentration, which determines the gradient, does not incraes as a factor of distance in the base region. Gradient defined as a factor (a number) of increasing, or decreasing a component, in this case, concentration, in some interval, in this case, distance, through the base region (for this case). Therefore, the concentration gradient in the base region of the claimed invention is defined as the factor, a number, that the concentration increases or decreases as a function of distance in the base region. So, gradient factor of 1 means that concentration, as a function of distance in the base region, increases, or decreases, in the base region by multiplying the concentration by number 1, through the base region, which results in the same concentration anywhere in the base region....".

To say that the absence of a concentration gradient is the same as a gradient of 1 or

zero, makes no sense. Stating that a gradient has a value of 1 means little unless the associated units are given but we do know that a gradient of 1 is finite. How a finite gradient can be the same as a zero gradient is not explained by examiner.

As far as we can determine, examiner is arguing that Frisina et al. and the present invention both teach concentration gradients in the sub-base region, the only difference being that theirs is finite while ours is zero. This highly original view of a zero gradient is readily adapted to arguing, for example, that pure water is no different from sea water; both contain sodium and chloride ions the only difference being that, in pure water, the concentration of these ions happens to be zero!

Applicants therefore respectfully request that the Board of Appeals reverse the holding of the Examiner in finally rejecting the Claims in the application. Allowance of all the claims is respectfully requested.

Respectfully submitted,

Stephen B. Ackerman

Reg. No. 37761

APPENDIX — COPY OF THE CLAIMS

12. A twin gain bipolar transistor comprising:

an N type silicon body having an upper surface;

an N+ buried collector located a first distance below said upper surface and having a thickness;

a secondary base region comprising P type silicon, throughout which boron ions are uniformly distributed, and extending a second distance below said upper surface;

a primary base region of boron doped P+ silicon, wholly within said secondary base region and extending a third distance below said upper surface; and

an emitter region comprising a region of N+ silicon wholly within the primary base region and extending a fourth distance below said upper surface.

13. The transistor described in claim 12 wherein said first distance is between about 630 and 732 microns.

14. The transistor described in claim 12 wherein the buried collector has a thickness between about 4 and 5 microns.

15. The transistor described in claim 12 wherein the resistivity of the secondary base region is between about 30 and 60 ohm cm.

16. The transistor described in claim 12 wherein said second distance is between about

0.6 and 0.8 microns.

17. The transistor described in claim 12 wherein resistivity of the primary base region is between about 0.2 and 0.3 ohm cm.

18. The transistor described in claim 12 wherein said third distance is between about 0.6 and 0.8 microns.

19. The transistor described in claim 12 wherein said fourth distance is between about 0.3 and 0.35 microns.

20. The transistor described in claim 12 wherein said N type silicon body is an N type silicon wafer or an N well within a silicon wafer.